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PATENT
Customer No. 22,852
New Attorney Docket No. 08350.0608-00000

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

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| In re Application of: | ) | |
| | ) | |
| Todd D. CREGER et al. | ) | Group Art Unit: 2128 |
| | ) | |
| Application No.:10/006,959 | ) | Examiner: DAY, HERNG-DER |
| | ) | |
| Filed: November 5, 2001 | ) | |
| | ) | |
| For: METHOD FOR COMPENSATING FOR VARIATIONS IN MODELED PARAMETERS OF MACHINES | ) | Confirmation No.: 2767 |

**Attention: Mail Stop Appeal Brief-Patents**
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

## TRANSMITTAL OF APPEAL BRIEF (37 C.F.R. 41.37)

Transmitted herewith is the APPEAL BRIEF in this application with respect to the Notice of Appeal filed on March 8, 2006.

This application is on behalf of

☐ Small Entity ☒ Large Entity

Pursuant to 37 C.F.R. 41.20(b)(2), the fee for filing the Appeal Brief is:

☐ $250.00 (Small Entity)

☒ $500.00 (Large Entity)

TOTAL FEE DUE:

| | |
|---|---|
| Appeal Brief Fee | $500.00 |
| Extension Fee (if any) | $0.00 |
| Total Fee Due | $500.00 |

☒ Enclosed is a check for $500.00 to cover the above fees.

PETITION FOR EXTENSION. If any extension of time is necessary for the filing of this Appeal Brief, and such extension has not otherwise been requested, such an extension is hereby requested, and the Commissioner is authorized to charge necessary fees for such an extension to our Deposit Account No. 06-0916. A duplicate copy of this paper is enclosed for use in charging the deposit account.

FINNEGAN, HENDERSON, FARABOW,
GARRETT & DUNNER, L.L.P.

Dated: May 17, 2006

By: Panyin A. Hughes
Panyin A. Hughes
Reg. No. 55,288

The PTO did not receive the following listed item(s) A Check for 500.00

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## APPEAL BRIEF UNDER BOARD RULE § 41.37

In support of the Notice of Appeal filed March 8, 2006, and further to Board Rule 41.37, Appellants present this brief and enclose herewith a check for the fee of $500.00 required under 37 C.F.R. § 1.17(c).

This Appeal is in response to the final rejection of claims 1-12 in the Office Action mailed on September 8, 2005 and the Notice of the Panel Decision from Pre-Appeal Brief Review mailed on April 24, 2006.

If any additional fees are required or if the enclosed payment is insufficient, Appellants request that the required fees be charged to Deposit Account No. 06-0916.

## Table of Contents

## **Real Party In Interest**

Caterpillar Inc. is the real party in interest.

## Related Appeals and Interferences

There are currently no other appeals or interferences, of which Appellants, Appellants' legal representative, or Assignee are aware of, that will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

## **Status Of Claims**

Claims 1-12 have been rejected. The rejection of claims 1-12 is being appealed.

A copy of these claims is provided in the attached Claims Appendix to this Appeal Brief.

## Status Of Amendments

No amendments to the claims have been filed subsequent to the final rejection of claims 1-12 mailed on September 8, 2005. However, an amendment to the specification was filed on January 9, 2006, and the Examiner indicated in an Advisory Action mailed on February 6, 2006, that the amendment would be entered for purposes of appeal.

## **Summary Of Claimed Subject Matter**

The invention relates generally to a method for compensating for variations in modeled parameters of a plurality of machines, and particularly, to a method for compensating for variations in modeled parameters of machines having similar characteristics.

The embodiment recited in independent claim 1 is directed to a method for compensating for variations in modeled parameters of a plurality of machines having similar characteristics and performing similar operations. *See* specification at page 2, paragraph no. 7, and Fig. 3. The method includes establishing a model development machine having a first at least one model to predict a machine parameter. *See* specification at page 2, paragraph no. 7, page 4, paragraph no. 22, and page 5, paragraph no. 26. The method also includes establishing at least one test machine having a second at least one model to predict the machine parameter. *See* specification at page 2, paragraph no. 7, page 5, paragraph no. 27, and Fig. 3. The method further includes obtaining data relevant to predicting the machine parameter on the at least one test machine and relevant to the characteristics and operations of the at least one test machine. *See* specification at page 2, paragraph no. 7, page 5, paragraph no. 27, and Fig. 3. The method further includes comparing the data from the at least one test machine to corresponding data from the model development machine. *See* specification at page 2, paragraph no. 7, page 6, paragraph no. 28, and Fig. 3. The method also includes updating at least one of an estimator and a model of each at least

one test machine in response to variations in the compared data. *See* specification at page 2, paragraph no. 7; page 6, paragraph no. 29, and Fig. 3.

The embodiment recited in independent claim 7 is directed to a method for compensating for variations in modeled parameters of a test machine compared to a model development machine. *See* specification at page 2, paragraph no. 8, and Figs. 3, 4, and 7. The method includes delivering a neural network model from the model development machine to the test machine. *See* specification at page 2, paragraph no. 8, page 7, paragraph no. 32, and Fig. 4. The method also includes determining a computed parameter on the test machine. *See* specification at page 2, paragraph no. 8, page 7, paragraph no. 33, and Fig. 4. The method further includes estimating the parameter on the test machine with the delivered neural network. *See* specification at page 2, paragraph no. 8, page 7, paragraph no. 34, and Fig. 4. The method also includes comparing the computed parameter with the estimated parameter. *See* specification at page 2, paragraph no. 8, page 7, paragraph no. 34, and Fig. 4. The method further includes updating at least one of an estimator and the neural network model on the test machine in response to variations in the computed parameter and the estimated parameter. *See* specification at page 2, paragraph no. 8, page 7, paragraph no. 35, and Fig. 4.

The embodiment recited in independent claim 10 is directed to a method for compensating for variations in modeled parameters of a plurality of machines having similar characteristics and performing similar operations with the use of a computer having a processor. *See* specification at pages 2-3, paragraph no. 9, and Fig. 5. The method includes sensing data from each of the plurality of machines relevant to the

modeled parameters, characteristics, and operations of each respective machine, and transmitting the data to the processor. *See* specification at pages 2-3, paragraph no. 9, page 8, paragraph no. 37, and Fig. 5. The method also includes determining a level of variability of the characteristics of each machine as a function of the data. *See* specification at pages 2-3, paragraph no. 9, page 8, paragraph no. 38, and Fig. 5. The method further includes determining a level of variability of the operations of each machine relevant to a respective work site as a function of the data. *See* specification at pages 2-3, paragraph no. 9, page 8, paragraph no. 39, and Fig. 5. The method also includes determining an aging factor of each machine as a function of the data. *See* specification at pages 2-3, paragraph no. 9, page 8, paragraph no. 40, and Fig. 5. The method further includes updating at least one of an estimator and a model of each machine encoded in the computer in response to the level of variability of the characteristics of each machine, the level of variability of the operations of each machine relevant to each work site, and the aging factor. *See* specification at pages 2-3, paragraph no. 9, pages 8-9, paragraph no. 42, and Fig. 5.

**Grounds of Rejection**

A. Claims 1-5, 7, and 8 stand rejected under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent Application Pub. No. 2002/0138240 A1 to Jelley et al. ("Jelley").

B. Claims 6 and 10-12 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Jelley in view of U.S. Patent No. 6,411,908 B1 to Talbott.

C Claim 9 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Jelley in view of Applicants' assertions.

## Argument

### A. The rejection of claims 1-5, 7, and 8 under 35 U.S.C. § 102(e) as being anticipated by Jelley should be withdrawn

The Examiner rejected claims 1-5, 7, and 8 under 35 U.S.C. § 102(e) as being anticipated by Jelley. To anticipate a claim, the reference must teach every element of the claim. *Union Carbide Chemicals & Plastics Tech. Corp. v. Shell Oil Co.*, 308 F.3d 1167, 1188, 64 USPQ2d 1545, 1560 (Fed. Cir. 2002); *see also* M.P.E.P. § 2131. The Board should reverse the rejection because Jelley does not teach every element of claims 1-5, 7, and 8.

Jelley discloses a method for predicting one or more operating characteristics of an earth boring drill bit operated under a set of known operating conditions. Jelley, page 2, paragraph 18. The method predicts an operating characteristic of a rotary earth boring bit design through the use of a numeric algorithm formed by a neural network. Jelley, page 2, paragraph 19. The neural network is trained by inputting each measured operating characteristic for each set of drill bit design parameters and each set of operating conditions into a digital computer programmed to provide neural network computations. Jelley, page 2, paragraph 20 and pages 4-5, paragraph 61. If the predicted results closely match the test results, then the neural network is considered to be properly trained. Jelley, page 5, paragraph 62. The numeric algorithm takes in as input a first set of numbers representing drill bit design parameters and a plurality of second sets of numbers representing operating conditions of the drill bit and outputs one or more operating characteristics of the drill bit at each set of operating conditions.

*See, e.g.*, paragraph nos. 19, 20, 61, and 62 of Jelley. In other words, Jelley utilizes a trained neural network to predict how an earth boring drill bit will operate under a set of known operating conditions.

Independent claim 1 recites, inter alia, "establishing a model development machine having a first at least one model to predict a machine parameter, establishing at least one test machine having a second at least one model to predict the machine parameter, comparing the data from the at least one test machine to corresponding data of the model development machine, and updating at least one of an estimator and a model of each at least one test machine in response to variations in the compared data." And independent claim 7 recites, inter alia, "delivering a neural network model from the developmental machine to the test machine, determining a computed parameter on the test machine, estimating the parameter on the test machine with the delivered neural network, comparing the computed parameter with the estimated parameter, and updating at least one of an estimator and the neural network model on the test machine in response to variations in the computed parameter and the estimated parameter." The Examiner contends that Jelley teaches the above limitations, offering the following characterization of Jelley on page 3-4 of the final Office Action:

> Regarding claim 1, Jelley et al. disclose[s] a method for compensating for variations in modeled parameters of a plurality of machines having similar characteristics and performing similar operations, including the steps of: establishing a model development machine having a first at least one model to predict a machine parameter (Training the neural network, paragraph [0061]); establishing at least one test machine having a second at least one model to predict the machine parameter (measured operating characteristics from tests, paragraph [0020]); obtaining data relevant to predicting the machine parameter on the at least one test machine and relevant to the characteristics and operations of the at least one test machine (input design parameters and operating conditions, paragraph

> [0019]); comparing the data from the at least one test machine to corresponding data of the model development machine (training neural network, paragraph [0020]); and updating at least one of an estimator and a model of each at least one test machine in response to variations in the compared data (generating a numeric algorithm from the trained neural network, paragraph [0020]).

Appellants respectfully submit that the rejection is based upon a mischaracterization of Jelley. As noted above, Jelley is directed to the use of a neural network to predict one or more operating characteristics of an earth boring drill operated under a set of known operating conditions, and employs a single model in its prediction. In other words, Jelley uses only a single model to predict a machine parameter. In contrast, Applicants' invention relies upon both the model development <u>machine</u> and the test <u>machine</u> to predict machine parameters. As recited in claim 1, Appellants' method requires "establishing a model development machine having a first at least one model to predict a machine parameter, [and] establishing at least one test machine having a second at least one model to predict the machine parameter." Applicants' disclosure thus employs two models and two machines that predict machine parameters.

Appellants have previously brought this difference between Jelley and the claimed invention to the Examiner's attention. In response, the Examiner stated that "the limitation, 'establishing a model development machine having a first at least one model to predict a machine parameter' is nothing more than providing a trained neural network disclosed in Jelley." *See* Advisory Action Before the Filing of an Appeal Brief at page 4. This assertion ignores the fact that providing a trained neural network requires only one model, whereas claims 1-5 and 7-8 require at least two models and two machines. Specifically, claims 1-5 and 7-8 recite, among other things, both "a model

development machine having a first at least one model to predict a machine parameter" and "at least one test machine having a second at least one model to predict a machine parameter." Jelley does not disclose nor suggest the use of two models. Thus, Jelley cannot anticipate claims 1-5, 7, and 8.

Furthermore, claim 1 also recites, among other aspects, "comparing the data from the at least one test machine to corresponding data of the model development machine; and updating at least one of an estimator and a model of each at least one test machine in response to variations in the compared data." Jelley does not disclose updating at least one of an estimator and a model of each at least one test machine <u>in response to variations in the compared data</u>. According to the Office Action, paragraph [0020] of Jelley teaches "training neural network," which allegedly discloses "comparing the data from the at least one test machine to corresponding data of the model development machine." *See* final Office Action at page 3. The Office Action further asserts that paragraph [0020] also teaches "generating a numeric algorithm from the trained neural network," which allegedly discloses "updating at least one of an estimator and a model of each at least one test machine in response to variations in the compared data." *See* final Office Action at page 4. Once again, Jelley has been mischaracterized.

Jelley discloses:

> d) training the neural network by inputting each measured drill bit operating characteristic for each set of drill bit design parameters and each set of operating conditions; and e) generating a numeric algorithm from the trained neural network in the form of a set of instructions comprising a series of mathematical operations which predicts an operating characteristic of a drill bit made in accordance with the drill bit design parameters and run under a given drill bit operating condition.

Jelley, page 2, paragraph 20.

This disclosure in Jelley merely teaches drill bit modeling that is able to predict an operating characteristic of a drill bit from a set of inputs based upon drill bit design parameters and a set of anticipated operating conditions, such that "only minimal field testing of the new design is required to verify its performance." *See* Jelley, page 2 paragraphs 17 and 18. In Applicants' claimed invention, data obtained from the test machine is compared to the model development machine and at least one of an estimator and a model associated with the test machine are updated in response to variations in the compared data. Consequently, the test machine benefits from the learning process the model development machine has undergone and incorporates that learned behavior into its model. *See, e.g.*, specification, pages 1-2, paragraphs 3-7. Jelley does not disclose or suggest comparing the data from the at least one test machine to corresponding data of the model development machine, or updating at least one of an estimator and a model of each at least one test machine in response to variations in the compared data.

With respect to independent claim 7, Jelley does not disclose or suggest "delivering a neural network model from the developmental machine to the test machine, determining a computed parameter on the test machine, estimating the parameter on the test machine with the delivered neural network, comparing the computed parameter with the estimated parameter, and updating at least one of an estimator and the neural network model on the test machine in response to variations in the computed parameter and the estimated parameter."

As discussed above, Jelley is directed to the use of a neural network to predict one or more operating characteristics of an earth boring drill operated under a set of known operating conditions, and employs a single neural network model in its prediction. In contrast, claim 7 relies upon both the developmental machine and the test machine to include neural network models to predict machine parameters. Specifically, claim 7 requires "delivering a neural network model <u>from</u> the developmental machine <u>to</u> the test machine" and "updating at least one of an estimator and <u>the neural network model on the test machine</u>." (emphasis added). In other words, whereas Jelley employs a single neural network to predict operating characteristics of earth boring drills, Applicants' disclosure in claim 7 employs two neural network models, one with the developmental machine and the other with the test machine. Therefore, Jelley cannot anticipate claim 7.

Moreover, claim 7 also requires "determining a computed parameter on the test machine, estimating the parameter on the test machine with the delivered neural network [delivered from the model development machine], comparing the computed parameter with the estimated parameter, and updating at least one of an estimator and the neural network model on the test machine <u>in response to variations in the computed parameter and the estimated parameter</u>." In this manner, the test machine benefits from the learning process the model development machine has undergone and incorporates that learned behavior into its model. *See, e.g.*, specification, pages 1-2, paragraphs 3-7. Jelley does not disclose or suggest comparing the computed parameter with the estimated parameter, or updating at least one of an estimator and

the neural network model on the test machine in response to variations in the computed parameter and the estimated parameter.

Claims 2-5, 8, and 9 each depend either directly or indirectly from one of independent claims 1 and 7, and each is therefore allowable for at least the same reasons stated above with respect to claims 1 and 7. In addition, each of these claims recite unique combinations that are neither taught nor suggested by the cited art, and therefore each is also separately patentable.

**B. The rejection of claims 6, 10-12 under 35 U.S.C. § 103(a) as being as being unpatentable over Jelley in view of Talbott. should be withdrawn**

Claims 6 and 10-12 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Jelley in view of Talbott. A prima facie case of obviousness requires that the prior art references, when combined, must teach or suggest every aspect of the claims. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991); *see also* M.P.E.P. § 2143. The Board should reverse this rejection because Jelley and Talbott, either alone or in combination, do not teach every element of claims 6 and 10-12.

Applicants respectfully assert that neither Jelley nor Talbott either alone or in combination disclose or suggest the claimed invention. Independent claim 10 recites, among other aspects, "determining an aging factor of each machine as a function of the data; and updating at least one of an estimator and a model of each machine encoded in the computer in response to the level of variability of the characteristics of each machine, the level of variability of the operations of each machine relevant to each work site, and the aging factor." The Final Office Action concedes that Jelley fails to

"expressly disclose determining an aging factor of each machine as a function of the data and updating at least one of an estimator and a model of each machine encoded in the computer in response to the aging factor." Final Office Action at page 7. Consequently, the Office Action relies on Talbott for this teaching. Even if Talbot does teach determining an aging factor of each machine as a function of the data and updating at least one of an estimator and a model of each machine encoded in the computer in response to the aging factor, the combination of Jelly and Talbot will not result in the claimed invention.

Specifically, Talbott does not remedy the deficiencies of Jelley discussed above. Jelley does not disclose "updating at least one of an estimator and a model of each machine encoded in the computer." Talbott also does not disclose this element. Talbott discloses a method for assembling condition monitoring histories of same-type machines that have lived in same-type environments and have failed as a result of the same failure mode. *See* Talbott, Abstract. The Office Action does not assert or suggest that Talbott discloses the element "updating at least one of an estimator and a model of each machine encoded in the computer," recited in claim 10. Accordingly, the combination of Jelley and Talbott would not render claim 10 obvious.

Claims 11 and 12 depend from independent claim 10 and are therefore allowable for at least the same reasons stated above that claim 10 is allowable. In addition, each of these claims recite unique combinations that are neither taught nor suggested by the cited art, and therefore each is also separately patentable.

Similarly, claim 6 depends from claim 1. As discussed above, Talbott does not remedy the deficiencies of Jelley. Therefore, claim 6 is allowable for at least the same reasons that claim 1 is allowable as discussed above.

### C. <u>The rejection of claim 9 under 35 U.S.C. § 103(a) as being as being unpatentable over Jelley in view of Applicants' assertions should be withdrawn</u>

Claim 9 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Jelley in view of Applicants' assertions. A prima facie case of obviousness requires that the prior art references, when combined, must teach or suggest every aspect of the claims. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991); *see also* M.P.E.P. § 2143. The Board should reverse the rejection because Jelley in combination with Applicants' assertions does not teach every element of claim 9.

The Office Action relies on Applicants' assertions that "[n]eural network weights are well known in neural network theory and applications." *See* Final Office Action, pages 8-9. However, this assertion does not cure the deficiencies noted above regarding Jelley. Moreover, claim 9 depends from independent claim 7 and is therefore allowable for at least the same reasons that claim 7 is allowable.

## Conclusion

For the reasons given above, pending claims 1-12 are allowable, and reversal of the Examiner's rejection is respectfully requested.

To the extent any extension of time under 37 C.F.R. § 1.136 is required to obtain entry of this Appeal Brief, such extension is hereby respectfully requested. If there are any fees due under 37 C.F.R. §§ 1.16 or 1.17 which are not enclosed herewith, including any fees required for an extension of time under 37 C.F.R. § 1.136, please charge such fees to our Deposit Account No. 06-0916.

Respectfully submitted,

FINNEGAN, HENDERSON, FARABOW,
GARRETT & DUNNER, L.L.P.

Dated: May 17, 2006

By: Panyin A. Hughes
Reg. No. 55,288

**Claims Appendix to Appeal Brief Under Rule 41.37(c)(1)(viii)**

1. (Previously Presented) A method for compensating for variations in modeled parameters of a plurality of machines having similar characteristics and performing similar operations, including the steps of:

establishing a model development machine having a first at least one model to predict a machine parameter;

establishing at least one test machine having a second at least one model to predict the machine parameter;

obtaining data relevant to predicting the machine parameter on the at least one test machine and relevant to the characteristics and operations of the at least one test machine;

comparing the data from the at least one test machine to corresponding data of the model development machine; and

updating at least one of an estimator and a model of each at least one test machine in response to variations in the compared data.

2. (Original) A method, as set forth in claim 1, wherein each of the model development machine and the at least one test machine includes a neural network for modeling a parameter of each respective machine, and wherein updating at least one of an estimator and a model includes the step of updating an estimator for each neural network in response to variations in the compared data.

3. (Original) A method, as set forth in claim 1, wherein each of the model development machine and the at least one test machine includes a neural network for modeling a parameter of each respective machine, and wherein updating at least one of an estimator and a model includes the step of updating each neural network in response to variations in the compared data.

4. (Original) A method, as set forth in claim 1, wherein obtaining data includes the step of obtaining data from each test machine relevant to operating characteristics of each respective test machine.

5. (Original) A method, as set forth in claim 1, wherein obtaining data includes the step of obtaining data from a work site in which a respective test machine is located, the data including data relevant to characteristics of the work site and operations of the test machine at the work site.

6. (Original) A method, as set forth in claim 1, wherein obtaining data includes the step of obtaining data relevant to aging of each test machine.

7. (Previously Presented) A method for compensating for variations in modeled parameters of a test machine compared to a model development machine, including the steps of:

delivering a neural network model from the model development machine to the test machine;

determining a computed parameter on the test machine;

estimating the parameter on the test machine with the delivered neural network;

comparing the computed parameter with the estimated parameter; and

updating at least one of an estimator and the neural network model on the test machine in response to variations in the computed parameter and the estimated parameter.

8. (Original) A method, as set forth in claim 7, wherein determining a parameter includes the step of calculating the parameter.

9. (Original) A method, as set forth in claim 7, wherein updating a neural network model includes the step of tuning at least one weight in the neural network model.

10. (Previously Presented) A method for compensating for variations in modeled parameters of a plurality of machines having similar characteristics and performing similar operations with the use of a computer having a processor, including the steps of:

sensing data from each of the plurality of machines relevant to the modeled parameters, characteristics, and operations of each respective machine;

transmitting the data to the processor;

determining a level of variability of the characteristics of each machine as a function of the data;

determining a level of variability of the operations of each machine relevant to a respective work site as a function of the data;

determining an aging factor of each machine as a function of the data; and

updating at least one of an estimator and a model of each machine encoded in the computer in response to the level of variability of the characteristics of each machine, the level of variability of the operations of each machine relevant to each work site, and the aging factor.

11. (Original) A method, as set forth in claim 10, wherein determining a level of variability of the operations of each machine relevant to a respective work site includes the step of determining a level of variability as a function of differences in characteristics between each work site.

12. (Original) A method, as set forth in claim 10, wherein determining an aging factor of each machine includes the step of determining a level of variability of operations of each machine as a function of aging of each respective machine.

**Evidence Appendix**

None.

## Related Proceedings Appendix

None.